

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
28 August 2003 (28.08.2003)

PCT

(10) International Publication Number
WO 03/071153 A1

(51) International Patent Classification⁷: **F16D 65/00**,
55/00, 65/847

Mats [SE/SE]; Lilla Mellanbergsvägen 3, S-423 37 Billdal
(SE). **BAGGE, Lars** [SE/SE]; Sjömansgatan 17, S-413 15
Göteborg (SE).

(21) International Application Number: PCT/SE03/00270

(22) International Filing Date: 19 February 2003 (19.02.2003)

(74) Agent: **FRÖHLING, Werner**; Volvo Technology Corpo-
ration, Corporate Patens, 06820, M1.7, S-405 08 Göteborg
(SE).

(25) Filing Language: Swedish

(26) Publication Language: English

(30) Priority Data:
0200493-5 20 February 2002 (20.02.2002) SE

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE,
SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ,
VC, VN, YU, ZA, ZM, ZW.

(71) Applicant (*for all designated States except US*): **VOLVO
LASTVAGNAR AB** [SE/SE]; S-405 08 Göteborg (SE).

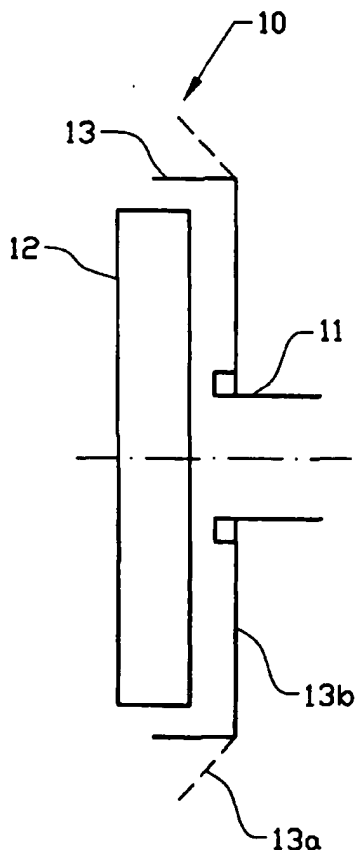
(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **SABELSTRÖM,**

[Continued on next page]

(54) Title: PROTECTION SHIELD FOR DISC BRAKE



(57) Abstract: The invention relates to a protection device (10) for, in a disk brake, protecting a brake disk (12) from dirt particles, where the protection device at least partly surrounds the brake disk (12), and where the protection device (10) comprises at least one protection means (13), where the protection means (13) consists at least partly of a material of which the shape is influenced by heat, where the protection means has a first end position which prevents dirt particles and relative wind from striking the brake disk directly and a second end position which allows relative wind to strike the brake disk directly so as to thus to obtain cooling of the brake disk, where the first end position occurs when the temperature of the protection means lies below a first temperature and the second end position occurs when the temperature of the protection means exceeds a second temperature.

WO 03/071153 A1



European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *with international search report*

TITLE

5 Protection shield for disk brake

FIELD OF THE INVENTION

The present invention relates to a protection device for a disk brake, for protecting the brake disk from
10 dirt particles, where the protection device is provided with at least one openable protection means for admission of heat-dissipating air for cooling the brake disk.

15 BACKGROUND

The functioning of disk brakes is affected negatively by contaminations, which can lead to changes in friction, uneven wear and also corrosion on disks and linings. It is known to equip disk brakes with a
20 protection plate so as to avoid contaminations spattering directly onto the brake disk. The contaminations may consist of inter alia water contaminated with dust, salt and/or mud. The protection plate can be designed so that it covers the brake disk
25 effectively but, when the brake disk is completely covered, cooling is impaired at the same time. A common compromise between covering and cooling of the brake disk is for the protection plate to cover the inside and the periphery of the brake disk. The outer side of
30 the brake disk is partly protected by the wheel rim. The protection plate covers that part of the brake disk which is uncovered, that is to say the part which is not covered by the brake caliper and brake lining.

35 Brakes on vehicles such as heavy-duty trucks, for example disk brakes, are sometimes subjected to very high power dissipation. In this connection, problems can arise if brake disks do not receive sufficient cooling. It has been found that the power dissipation

- 2 -

is usually quite low at low speed. In many cases, low speed is due to a poor road standard, for example in the case of transporting lumber on forest roads, the road environment usually being very dirty as well.

5 Construction vehicles also are driven at low speed when the environment is dirty, for example in the case of road construction. In this connection, it is desirable for the protection against dirt to have maximum effectiveness when the vehicle is driven at low speed.

10

On good roads, the speed is normally considerably higher, with an increased requirement for high braking effect. In this connection, it is desirable for the cooling to have maximum effectiveness. These varying
15 requirements can be satisfied by a mechanical device which can adjust a damper or the like which adapts the admission of cooling air to the brake according to the current need. It is necessary, however, that such devices cannot be put out of operation, which in turn
20 could lead to impaired braking effect, that is to say the overall safety of the vehicle being put at risk.

Such a device adapted for motorcycles is known, for example, from JP05060158, which discloses a protection
25 plate for a disk brake, a damper plate which is displaceable along the outer edge of the protection plate being maneuverable by means of a piston cylinder for exposing a number of hole openings. This known solution is complicated and sensitive to contamination,
30 for which reason it is not a realistic possibility for application to heavy-duty trucks, which are expected to cope with service intervals of roughly 50,000 km. It is also a very expensive solution for a truck which has at least four brake disks. The solution is moreover
35 intended primarily for a brake disk which is covered on both sides, which is the case on motorcycles.

- 3 -

SUMMARY OF THE INVENTION

One object of the invention is therefore to produce a protection device which meets the requirements indicated above and at the same time is simple and reliable.

To this end, the protection device according to the invention is characterized in that the protection device comprises at least one protection means which consists at least partly of a material of which the shape is influenced by heat, where the protection means has a first end position which prevents dirt particles and relative wind from striking the brake disk directly and a second end position which allows relative wind to strike the brake disk directly so as thus to obtain cooling of the brake disk, where the first end position occurs when the temperature of the protection means lies below a first temperature and the second end position occurs when the temperature of the protection means exceeds a second temperature. By virtue of this design of the protection device, advantageously simple and effective self-adjusting opening and closing of one or more ventilation openings at the brake disk are obtained.

In a first advantageous illustrative embodiment of the invention, the protection means changes shape continuously from the first end position to the second end position. By virtue of this design of the protection device, stepless adjustment of the cooling of the brake disk is obtained.

In a second advantageous illustrative embodiment of the invention, the protection means changes shape stepwise from the first end position to the second end position. By virtue of this design of the protection device, a rapid increase in the cooling of the brake disk is obtained when a given temperature has been reached.

- 4 -

In a third advantageous illustrative embodiment of the invention, the protection means is arranged so as to react to heat radiation from the brake disk. By virtue of this design of the protection device, an increase in the cooling of the brake disk is obtained when the brake disk becomes hot.

In a fourth advantageous illustrative embodiment of the invention, the protection means is L-shaped. By virtue of this design of the protection device, a protection shield which also covers the periphery of the brake disk is obtained.

In a fifth advantageous illustrative embodiment of the invention, the heat-influencable material consists at least partly of a bimetal. By virtue of this design of the protection device, a protection shield which opens and closes the air supply for cooling a brake disk is obtained in a simple and inexpensive manner.

20

BRIEF DESCRIPTION OF FIGURES

The invention will be described in greater detail below with reference to illustrative embodiments shown in the accompanying drawings, in which

25

FIG. 1 is a partial perspective view of a protection device according to a first illustrative embodiment of the invention,

FIG. 2 shows in plan view a protection device according to a second illustrative embodiment of the invention,

FIGS 3-5 show in section along the line A-A in Fig. 2 three different variants of the illustrative embodiment of the invention shown in Fig. 2, and

35

FIG. 6 shows in perspective another variant of the illustrative embodiment shown in Fig. 2.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

- 5 -

The protection device 10 shown in the figures is intended to be mounted on the wheel suspension 11, suitably at each of the wheels on a vehicle. The aim is to protect the brake disks 12 of the vehicle as well as possible from contact with dirt particles.

In the illustrative embodiment according to Fig. 1, the protection device forms a shield which is angled in an L-shaped manner around the edge of the brake disk 12.

10 The shield is made from a material of which the shape is influenced by heat, preferably a bimetal sheet metal. A number of U-shaped punchings are made in the sheet metal, along the outer, peripheral portion of the shield. In this way, individual tongues 13 have been

15 formed, which are arranged so as to be bent radially outward under the influence of heat. When the tongues 13 are bent outward, openings 14 are formed, which make it possible for cooling air to move past the shield and transport heat away from the brake disk 12. Tongues

20 made of bimetal plate can also be attached to a shield made from ordinary sheet metal, for example by riveting.

It is also possible for the shield to cover the brake

25 disk on both sides, that is to say that the shield is angled in a U-shaped manner around the edge of the brake disk 12. This enhances the dirt-protection characteristics of the shield. With an effective design of the tongues and openings of the protection shield,

30 this can be done without the cooling of the brake disk being impaired. It is of course also possible to locate tongues on the side or sides of the shield.

The protection device is intended to protect the brake

35 disk against dirt spatter when the temperature of the brake disk is low, that is to say when the braking effect requirement is low. A suitable temperature at which the protection device is to begin to open may be, for example, when the temperature of the brake disk is

- 6 -

around 200°C. Depending on the design of the protection device, for example the spacing between the protection device and the brake disk, the heat-influencing material is adapted so that the protection device
5 begins to open at the desired temperature. When the brake disk has reached a temperature in the range 250-300°C, the protection device should be completely open. In one embodiment, two different heat-influencing materials can be combined so that one material opens at
10 a lower temperature so as to provide a certain cooling and another material opens at a higher temperature so as to provide maximum cooling.

Figure 2 shows an illustrative embodiment of the
15 invention where the protection device comprises a number of separate tongues 13 arranged in series next to one another. These tongues are arranged radially with a radially inner end connected to the wheel suspension 11 of a vehicle, as can be seen from Figs 3-
20 6, which also show that the tongues are angled in an L-shaped manner around the edge of the brake disk 12. The tongues 13 can cover the edge of the brake disk completely or partly. The protection device is intended to cover that part of the brake disk which is not
25 covered by the brake caliper and brake lining.

In the variant according to Fig. 3, the heat-influencable material has been located in the angle between the two legs 13a, 13b of the tongues concerned.
30 In this connection, the leg 13a can swing away from the brake disk 12 when the material reacts to heat radiation from the disk. The opening then formed can be seen as a sector-shaped arc portion which makes it possible for relative wind to strike the brake disk for
35 cooling.

In the variant according to Fig. 4, the heat-influencable material has been located next to the attachment of the tongue to the wheel suspension 11, so

- 7 -

that the tongue 13 as a whole can swing away from the brake disk 12 when the material reacts to heat radiation from the disk.

- 5 In the variant according to Fig. 5, the tongue 13 as a whole consists of the heat-influencable material, so that in this case also the tongue 13 as a whole can swing away from the brake disk 12 when the material reacts to heat radiation from the disk.

10

- In the variant according to Fig. 6, the oblong tongues 13 are completely plane and located essentially in the same plane as the opening and are rotatable out of this plane about their longitudinal axis. In this case, the
15 tongues 13 can be angled in such a way that they direct the air flow in toward the brake disk. In this case too, the tongues can be L-shaped when the periphery of the brake disk needs to be protected.

- 20 The invention is not to be regarded as being limited to the illustrative embodiments described above, but a number of further variants and modifications are conceivable within the scope of the following patent claims. For example, different types of means of
25 attachment can be used for mounting tongues on the wheel suspension or for attaching the heat-influencable material to the protection device 10.

- 8 -

PATENT CLAIMS

1. A protection device (10) for, in a disk brake, protecting a brake disk (12) from dirt particles, where
5 the protection device partly surrounds the brake disk (12), and where the protection device (10) comprises at least one protection means (13), characterized in that said at least one protection means (13) consists at least partly of a material of which the shape is
10 influenced by heat, where the protection means (13) has a first end position which prevents dirt particles and relative wind from striking the brake disk directly and a second end position which allows relative wind to strike the brake disk (12) directly so as thus to
15 obtain cooling of the brake disk (12), where the first end position occurs when the temperature of the protection means (13) lies below a first temperature and the second end position occurs when the temperature of the protection means (13) exceeds a second
20 temperature.

2. The protection device as claimed in claim 1, characterized in that the protection means (13) changes shape continuously from the first end position to the
25 second end position.

3. The protection device as claimed in claim 1, characterized in that the protection means (13) changes shape stepwise from the first end position to the
30 second end position.

4. The protection device as claimed in any one of claims 1 to 3, characterized in that the protection device is arranged so as to be located in a fixed
35 manner in relation to a brake caliper belonging to the disk brake.

- 9 -

5. The protection device as claimed in any one of claims 1 to 4, characterized in that said at least one protection means (13) is arranged so as to react to heat radiation from the brake disk (12).

5

6. The protection device as claimed in any one of claims 1 to 5, characterized in that a plurality of protection means (13) are designed as radial tongues arranged with a radially inner end connected to the wheel suspension (11) of a vehicle.

10

7. The protection device as claimed in claim 6, characterized in that said at least one protection means (13) is rotatable about its longitudinal axis.

15

8. The protection device as claimed in any one of claims 1 to 5, characterized in that a plurality of protection means (13) are designed as a number of peripherally movable tongues located along an outer edge of the protection device (10).

20

9. The protection device as claimed in any one of claims 1 to 8, characterized in that said at least one protection means (13) forms an opening (14) in the form of a sector-shaped arc portion when the protection means (13) is in its second end position.

25

10. The protection device as claimed in any one of claims 1 to 9, characterized in that said at least one protection means (13) is L-shaped.

30

11. The protection device as claimed in claim 10, characterized in that the heat-influencable material is located in the angle between the two legs (13a, 13b) of said at least one L-shaped protection means (13).

35

12. The protection device as claimed in any one of claims 1 to 11, characterized in that the heat-

- 10 -

influencable material is located at the radially inner end of said at least one protection means (13).

13. The protection device as claimed in any one of
5 claims 1 to 12, characterized in that said at least one protection means (13) consists at least partly of a bimetal.

14. The protection device as claimed in any one of
10 claims 1 to 13, characterized in that the protection device (10) is located so close to the brake disk (12) that it is capable of absorbing and dissipating heat from the brake disk (12).

1/3

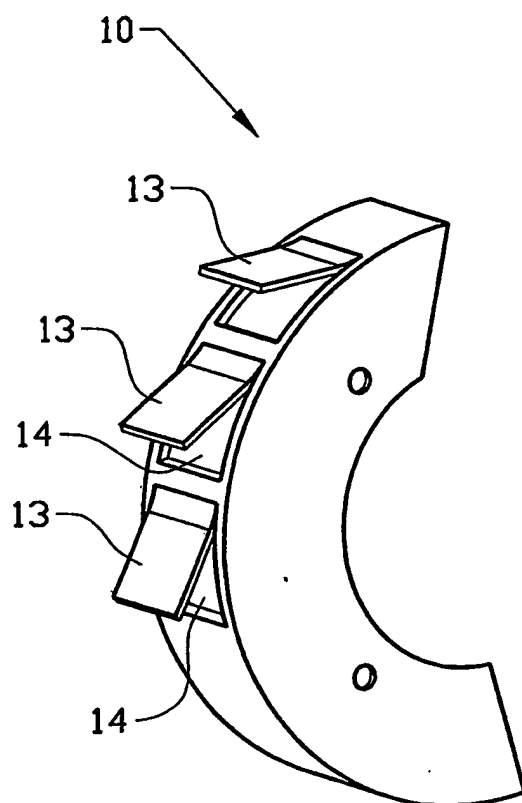


Fig.1

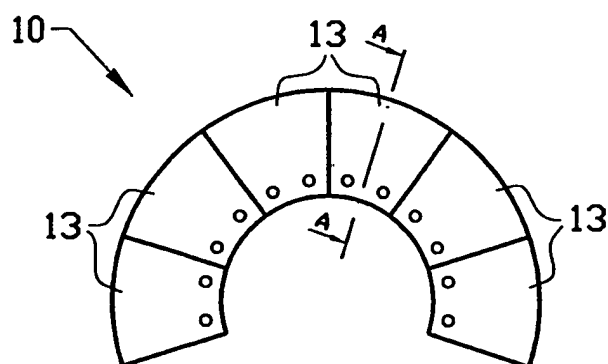
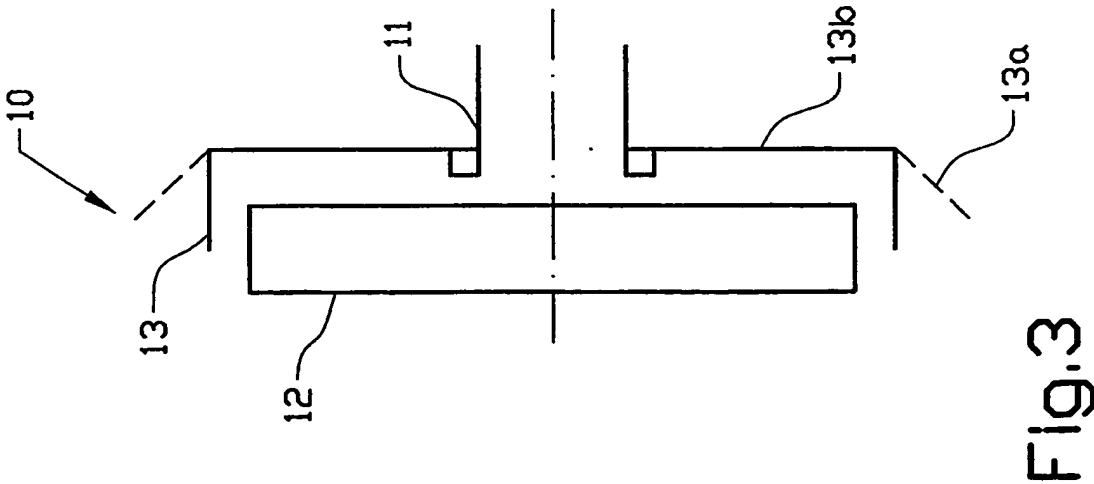
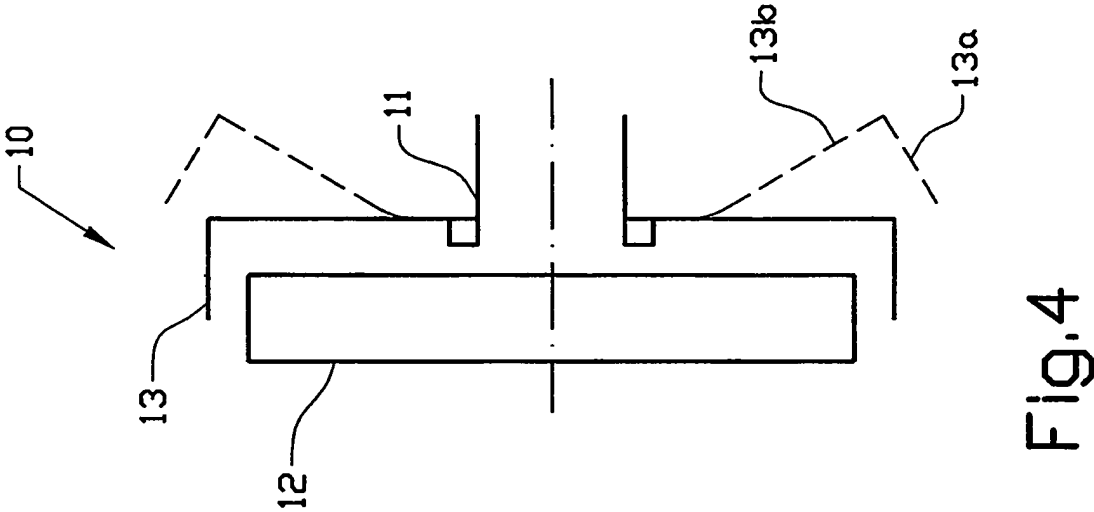
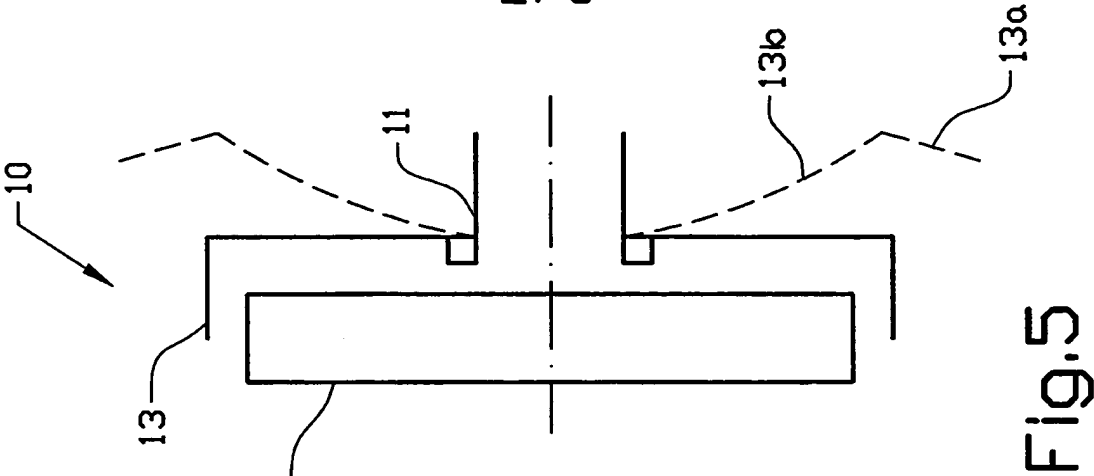


Fig.2



3/3

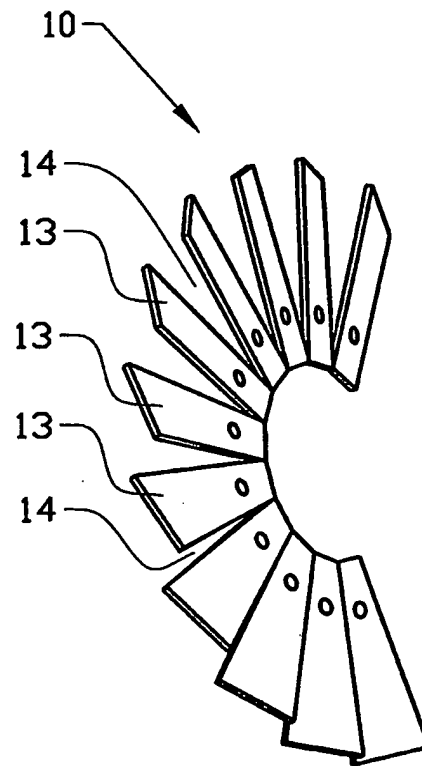


Fig.6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 03/00270

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: F16D 65/00, F16D 55/00, F16D 65/847

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60T, F16D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol.008, no.152, 14 July 1984 (1984-07-14) & JP 59047531 A (AKEBONO BRAKE KOGYO KK) 17 March 1984 (1984-03-17) fig 4-6, abstract --	1-5,8,12-14
A	EP 0204433 A1 (THREE ACQUIRING CORP), 10 December 1986 (10.12.86), column 5, line 5 - line 12, abstract --	1,4,14

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

9 May 2003

Date of mailing of the international search report

19-05-2003

Name and mailing address of the ISA/

Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

Alexandra Jarlmark/EK
Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 03/00270

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol.012, no.113, 09 April 1988 (1988-04-09) & JP62242142 A (DAIDO STEEL CO LTD) 22 October 1987 (1987-10-22) fig 2,8, abstract --	1,3,5,8,14
A	US 4226308 A (NISHIYAMA ET AL), 7 October 1980 (07.10.80), figures 1,3, abstract --	6
A	DE 3446058 A1 (BERGISCHE STAHL-INDUSTRIE), 26 June 1986 (26.06.86), figures 1,2, abstract --	1,5,6,10,14
A	US 6155650 A (BARGER), 5 December 2000 (05.12.00), figure 2, abstract --	1,14
A	DE 4344051 A1 (VOLKSWAGEN AG), 21 July 1994 (21.07.94), figures 1,2, abstract -- -----	1,14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 03/00270

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
EP	0204433	A1	10/12/86	SE DE	0204433 T3 3683803 A	19/03/92
US	4226308	A	07/10/80	NONE		
DE	3446058	A1	26/06/86	NONE		
US	6155650	A	05/12/00	CA	2316132 A	22/03/01
DE	4344051	A1	21/07/94	NONE		